Thank you. I am very pleased to be here today to provide an update to DARPA's Airborne Communications Node program.

The Airborne Communications Node, also known as ACN, has completed Phase I of a multi-phase technology development plan.

During Phase I, the focus was on the development of a system level design for achieving Beyond Line of Sight connectivity between with legacy radio systems.

Critical elements of Phase I addressed various co-site mitigation methods that are necessary when you have many active apertures in a small physical space.

Additionally, development of component technology that will allow such a system to fit within the Size, Weight, and Power constraints of a Global Hawk, was pursued.

ACN Now enters Phase II of its development with a broader and enhanced vision.

ACN represents the confluence of many past DARPA technology programs that have come together to allow a system such as ACN to be developed.

The technology being developed for ACN will be fully scaleable and therefore capable of installation on more than air platforms.

A fiscal result of this scaleability is the production large numbers of identical components.

This will effectively drive the cost curve to lower unit costs and make this technology very affordable.

Additionally, it was realized that the current state of the art could be pushed to incorporate the ability to receive Signals of Interest.

This is a very significant challenge since Signals Intelligence, or SIGINT, receivers need to receive very weak signals over a wide frequency range.

The difference between a SIGINT receiver collecting at very low power and a communications transmitter emitting at very high levels requires very large and crisp electronic isolation between the two functions.

Therefore, in Phase II, the program called ACN is MORE than airborne and MORE than communications.

The program vision is to provide the technology to enable affordable and autonomous Wide Area, Wireless, Communications and Signals Intelligence for Joint and coalition forces in a theater of operation.

As an airborne node, ACN can establish an early and robust infrastructure for intra-theater line-of-site relay and beyond line-of-site reach-back inter-connectivity.

The mobility that is offered by an air platform for this payload allows the fight to advance unimpeded by the time it takes to get the communications infrastructure established.

It will move and adjust Communications and SIGINT services to the flow of battle.

ACN will be Adaptable. This means that it will be capable of dynamic reconfiguration as the needs of the mission change.

It will be scaleable. This means is will be capable of increased performance by adding more modules. ACN will be robust.

This means is will be capable of reliable operations in different environments.

It will be assured.

This means that it will be capable of protecting information and resources from unauthorized users.

And lastly, it will be seamless. This means that it will be capable of transparently connecting radio and data systems of the future to those legacy systems of the past.

ACN will harmonize with disparate communications systems, radios and networks, acting as an any-to-any gateway.

True battlefield communications mobility will become a reality as ACN provides the critical element by reducing the theater communications infrastructure and giving the warfighter unparalleled access to information.

An example of an ACN utility shows a mixture of high and low altitude communications nodes providing flexible, responsive and cost effective communications and SIGINT services to armies on the move.

An ACN will increase the range at which mobile units can communicate with those members. Terrain blockage is mitigated and long relay allows a deep strike asset to become part of the up-front fight.

Beside beyond line of sight connectivity, other areas where an ACN may be useful include: Relief of SATCOM Over-subscription; "Surge" Communications and Tactical SIGINT Capacity; Reduced Logistics for Communications Infrastructure; Enhanced Mobility; and a yet to be fully realized, SIGINT/Communications Synergy.

The cross-banding capability of the ACN payload will give tactical users access to SATCOM without the need to use SATCOM terminals.

This capability will increase the versatility of tactical unit communications equipment without requiring additional hardware.

Simply by reducing the propagation path from 40,000 km to 20 km allows the ground user to transmit with much less power and decreases the probability of detection on the ground.

ACN will provide beyond line of sight relay services for combat net radios. Additionally, theater data networks such as High Capacity Line of Sight (HCLOS), Enhanced Position Location Reporting System (EPLRS), and Joint Tactical Information Data System (JTIDS) will also be relayed or waveform translated to get the right information to the right user at the right time.

By providing a theater communications infrastructure that can be deployed from CONUS, if placed on a Global Hawk, the size of the theater communications infrastructure and its accompanying tail are reduced and a lighter, and more mobile force is the result.

The same technology that allows the ACN to be so flexible in providing communications to the warfighter, also allows it to function as a signals collector. Communications and SIGINT are two sides to the same coin, and SIGINT becomes a logical extension of ACN capabilities.

ISR sensors are greatly enabled by the organic relay and reachback services offered by an ACN.

In 1997, a J6 study, "The Demand for SATCOM Today and in the Future" discovered that most of the communications requirement, as measured in bits per second, stays within the theater. About the same amount of data enters and leaves the theater but over two and a half times that amount swirls and churns within the theater.

Most of that data travels over 80,000 kilometers between units that are just beyond line of sight, or only 10's of kilometers apart.

Currently SATCOM is used for this bridge.

ACN can provide the in theater connections as well as provide relay services to the nearest fiber head for the low latency and long backhaul communications.

ACN can be the gapfiler to augment and supplement SATCOM resources.

Demand for communications services will change over time as the battle evolves.

The rate at which communications requirements can be satisfied in theater generally lags the rate at which those services are needed.

Without an a priori expectation of need, satcom services may not be available until after a somewhat lengthy negotiation to obtain additional transponder bandwidth and a host nation agreement regarding landing rights.

ACN will be dynamically configurable and can be tailored to meet changing communications demand.

The ACN supports the communications needs of all phases of an operation and can be there to meet surge requirements. ACN allows the theater to match communications capacity to the demand rather than having communications capacity throttle the demand.

The scaleable payload envisioned for ACN will allow it to be placed on a variety of vehicles.

Small light payload may give a few channels of additional communications capacity to a small area.

A large payload of many modules will give potentially hundreds of channels and large amounts of bandwidth over a larger area. These flying hubs can also be networked together in a dynamic, ever-changing typology. This mobile ad hoc networking will be the enabler of virtual private networks, VPNs, that will enhance data integrity and confidentiality.

A large amount of tactical communications equipment and personnel were required to support the Army Communications Infrastructure for the Gulf War. Many large air and sea lifters were needed to deploy these assets. An airborne configuration of ACNs could have supported the in- theater communications needs with less ground infrastructure and therefore, less reliance on air and sealift.

By reducing the logistics requirement, the mobility of the force is increased. Further, since the ACN communications infrastructure is not fixed, it can support the mobile warfighter and satisfy a significant portion the rising demand for mobile communications services.

The symbiosis between communications and signals intelligence is just now beginning to be recognized. When you are communicating, you are also performing SIGINT. The signal you want to receive however, is well known to you.

While receiving the communications signal of interest, ACN equipment can be listening over a much wider bandwidth for other signals of interest.

In doing so, an ACN can collect information that allows: emitter characterization; emitter Geo- location (quickly and precisely if there are multiple ACNs aloft); adversary nodal or traffic analysis, and lastly; spectrum mapping.

ACN will extend the reach of forward-deployed tactical sensor platforms and support sensor reach-back ISR missions.

As forces build in theater, the ACN will enable high-paced mobile deployments and an increase in the breadth of the battle by supporting real- time situational awareness and real-time ISR over large theaters.

RF is RF and Bit are Bits.

What separates a communications mission from a SIGINT mission is the way that the digitized RF is processed.

Advances in technology now allow these previously different mission areas to converge to a common architecture with a common suite of hardware.

Both employ similar receiver functionality.

This provides the opportunity to design a multi-mission platform with a common architecture approach.

The converged architecture could be programmed "on the fly" to support multiple missions simultaneously or nearly simultaneously, for greater flexibility and spectrum dominance. Offensive Information Warfare is enabled.

This multi-mission architecture will potentially fundamentally change the way we will fight in the future.

Ever platform with ACN equipment becomes multi-mission --- talking, hearing, and potentially seeing --- all at the same time?

One of the primary objectives of Phase II is to develop a payload that is scaleable and modular.

Scalability will allow the payload to be integrated on a variety of platforms and modularity will facilitate maintainability and upgradeability.

The platform independent scalability and modularity enable reduced life cycle costs by offering a common suite of hardware and software.

Economies of scale are achieved at the module level rather than system level.

Maintenance concepts are streamlined by this commonality.

Advanced antenna technology allows re-configurable and stacked apertures that enable large frequency operating ranges within a small physical space.

Wideband Silicone Carbide amplifiers offer high gain over a wide bandwidth while achieving a small form factor and low input power.

High power Micro Electro-Mechanical Switches, MEMS, further enable reduced size, weight, and power for antennas and RF components.

Vertical Cavity Surface Emitting Lasers, VCSEL, are employed as a high speed any-to-any card interconnects.

This will allow modulation; de-modulation and processing to occur without bus speed constraints and at low overhead.

Innovative null steering and interference mitigation techniques take advantage of bulk acoustic wave technology.

This reduces the need for many meters of delay line cables down to only centimeters of material.

Phase II of the ACN program pushes the limits of these technologies.

Setting up and maintaining battlefield networks today takes a significant amount of manpower.

As the fighting force push to become lighter and more mobile, the manpower projected to manually maintain highly mobile and dynamic networks can be overwhelming and essentially impractical.

A significant technology thrust area during Phase II is the development of a mobile ad hoc network structure that automatically adds and drops users as they enter and leave networks.

If successful, this technology can also be transitioned to terrestrial networks.

The ACN Phase II program started with the program kickoff earlier this year and will conclude with a Phase III readiness review in August 2002.

Two teams were selected for Phase II.

One is being led by Raytheon and the other is led by Sanders.

Several reviews are scheduled throughout the program to report on the status of the overall system design and predicted system performance.

An innovative contracting strategy has mutually agreed to performance threshold and goals at milestones along the development path.

In closing, ACN Phase II will concentrate on key technology developments that will enable a multi-mission RF and network architecture.

This will be the foundation that will enable any platform to perform virtually any mission at any time.

The ACN will support the Service's need for high-bandwidth, beyond line-of- sight connectivity with assurance and security, while supporting signals intelligence (SIGINT) collection.

The emphasis is on enabling revolutionary technology that can support a transition to the Services to build a multi-mission payload beginning in FY2003.

Thank you for your attention during this briefing and for your attendance at DARPATECH 2000.

I hope that you have found this information interesting and useful.

If you would like to discuss any areas in more detail, I am available at the email address listed on the cover slide.